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**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

013550-087

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)

09/242893

INTERNATIONAL APPLICATION NO.
PCT/CA97/00600

INTERNATIONAL FILING DATE
26 August 1997

PRIORITY DATE CLAIMED
26 August 1996

TITLE OF INVENTION
MICROWAVABLE CONTAINER

APPLICANT(S) FOR DO/EO/US

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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and the PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
- ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
- ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
- ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

Publication No. WO 98/08750 with International Search Report; International Preliminary Examination Report and PCT Written Opinion.

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.50)		INTERNATIONAL APPLICATION NO. PCT/CA97/00600		ATTORNEY'S DOCKET NUMBER 013550-087	
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17. <input checked="" type="checkbox"/> The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO \$840.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) \$670.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$760.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$970.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$96.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$ 840.00
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)). <input type="checkbox"/> 20 <input type="checkbox"/> 30		\$ -0-
Claims	Number Filed	Number Extra
Total Claims	35 -20 =	15
Independent Claims	1 -3 =	0
Multiple dependent claim(s) (if applicable)		+ \$260.00
TOTAL OF ABOVE CALCULATIONS =		\$ 1,110.00
Reduction for 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).		\$ -0-
SUBTOTAL =		\$ 1,110.00
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)). <input type="checkbox"/> 20 <input type="checkbox"/> 30		\$ -0-
TOTAL NATIONAL FEE =		\$ 1,110.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +		\$ -0-
TOTAL FEES ENCLOSED =		\$ 1,110.00
		Amount to be: refunded \$
		charged \$

a. ☒ A check in the amount of \$ 1,110.00 to cover the above fees is enclosed.

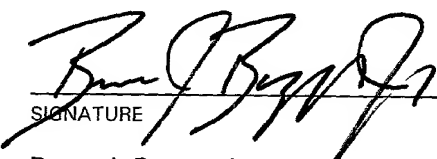
b. ☐ Please charge my Deposit Account No. 02-4800 in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 02-4800. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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32,344
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09/242893

MICROWAVABLE CONTAINER

300 Rec'd PCT/PTO 26 FEB 1999

FIELD OF THE INVENTION

5 The present invention relates to containers for food products and in particular to a microwavable container and to a tray for the same.

BACKGROUND OF THE INVENTION

10 Microwave ovens have become a principle form of cooking food in a rapid and effective manner and the number of food products available for preparation in a microwave oven is constantly increasing. As the market for microwavable food products has increased, so the sophistication required from such food products has also increased. There is, therefore, a continuing demand to improve the quality of food prepared in a microwave oven and to ensure that when it is presented to the consumer, the food is attractive and meets the standards
15 normally associated with such food.

20 Foods that are specially prepared for cooking within a microwave oven are delivered to the consumer in containers that may be used directly within the microwave oven to facilitate preparation. These containers must therefore not only be capable of containing the food product during transport in an effective manner but must also be capable of contributing to the cooking of the food within the microwave oven and the subsequent presentation of the food.

25 As the demand for more sophisticated food products increases, so the demand for effects, particularly appearance, normally associated with food preparation also increases. For example, it is desirable for a food product that includes a pastry shell or lid to have a browned appearance, so that it appears to have been baked. While these effects can be produced in isolation, it becomes more difficult to produce such an effect in combination with a container that can also uniformly heat the food within a time that offers advantages over conventional cooking techniques.

30 Typically, the areas in which browning or crisping are required are those on the outer surfaces of the food product. Those areas typically receive the highest proportion of incident microwave radiation and therefore cook or heat the

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quickest. On the other hand, there are areas of the food product that are relatively shielded from incident microwave radiation or which exist in a region of a minimum RF field strength and which therefore require longer cooking periods. If, however, a longer cooking period is provided, the outer surfaces of the food product tend to char and burn, leading to an unacceptable food product.

Various attempts have been made in the past to provide containers that will produce effects normally associated with cooked foods. For example, U.S. Patent No. 5,322,984 to Habeger, Jr. Et al. suggests a container having heating devices on the bottom wall and possibly the top wall of the container. The heating devices are designed to provide a charring effect normally associated with barbecuing by directing energy normally not incident upon the food product into specific regions. This is purported to produce a localised charring of the food product. Overall, however, such containers have not been successful. The charring effect produced on the food product may be attributed to the high field intensities and associated induced currents that result from the concentration of energy at particular locations. In practice it is found that those induced currents may also cause charring and burning of the container itself.

It has also been found that in order to produce the required results for the preparation of the food product, the container must be capable of controlling distribution of energy about the food product, to utilize the energy in the most efficient manner, and at the same time ensure that the food product and the container provide a pleasant and acceptable finished food product.

It is therefore an object of the present invention to provide a novel microwavable container, a tray for a microwavable container and a microwave energy heating insert.

SUMMARY OF THE INVENTION

According to one aspect of the present invention there is provided a microwavable container comprising:

an outer sleeve;

an inner tray within said sleeve and having a bottom wall and at least

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one upstanding side wall about the periphery of said bottom wall;

a first active microwave energy heating element within said sleeve and disposed opposite said tray; and

5 a second active microwave energy heating element on said tray, said second microwave energy heating element having patterns of microwave energy interactive material on the bottom and side walls of said tray configured to permit a controlled degree of penetration of incident microwave energy through said bottom wall to channel microwave energy towards a central region of said tray and to promote browning of a food product carried by said tray about the periphery thereof.

10 In one embodiment, the microwave energy interactive material on the side walls has a plurality of slots formed therein. The slots adjacent the corners of the tray are curved upwardly to enhance browning of the food product in the corner regions of the tray. Preferably, opposed ends of at least some of the slots are bulbous to further enhance the heating effect by evening out the field strength along the length of the slots. A susceptor may be used to overlie the microwave energy interactive material on the bottom and side walls.

15 In one embodiment, the pattern of microwave energy interactive material on the bottom wall includes at least one and preferably a pair of large meandering loops. It is preferred that the length of the loops is approximately equal to an integer multiple of the effective wavelength of the incident microwave energy. It is also preferred that the pattern of microwave energy interactive material on the bottom wall further includes a ring about the peripheral edge of the bottom wall and wherein the meandering loops are open and are coupled to the ring by bridges.

25 Preferably, the first active microwave energy heating element includes a pattern of microwave energy interactive material having a ring about the periphery of the microwave energy heating element and defining a centrally located aperture. In one embodiment, an array of microwave energy interactive elements are located within the aperture. The microwave energy interactive elements can be 30 in the form of circular or hexagonal islands. Alternatively, the microwave energy interactive elements can be in the form of loops with each of the loops surrounding

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an island.

According to another aspect of the present invention there is provided a tray for a microwavable container comprising:

a bottom wall;

5 at least one upstanding side wall about the periphery of said bottom wall; and

an active microwave energy heating element within said tray, said active microwave energy heating element having patterns of microwave energy interactive material on the bottom and side walls of said tray configured to permit a controlled degree of penetration of incident microwave energy through said bottom wall to channel microwave energy towards a central region of said tray and to promote browning of a food product carried by said tray about the periphery thereof.

According to still yet another aspect of the present invention there is provided an active microwave energy heating insert to be placed under a microwavable container comprising:

a substrate; and

an active microwave energy heating element on said substrate, said active microwave energy heating element including a pattern of microwave energy interactive material thereon configured to permit a controlled degree of penetration of incident microwave energy therethrough to channel microwave energy towards a central region of a microwavable container thereon.

The present invention provides advantages in that the microwavable container design is such to heat generally uniformly a food product while browning and drying the outer periphery of the food product in one package. This design is particularly suited to cooking pies and other similar products having a crust.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will now be described more fully with reference to the accompanying drawings in which:

Figure 1 is a side elevational view of a microwavable container in

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accordance with the present invention;

Figure 2 is a plan view of an active microwave energy heating element forming part of the microwavable container of Figure 1;

5 Figure 3 is a cross-sectional view of a portion of the microwavable container of Figure 1;

Figure 4 is a perspective view of a tray forming part of the microwavable container of Figure 1;

Figure 5 is a top plan view of a blank which can be constructed to form the tray of Figure 4;

10 Figure 6 is a plan view of an alternative embodiment of an active microwave energy heating element for the microwavable container of Figure 1;

Figure 7 is a plan view of yet another embodiment of an active microwave energy heating element for the microwavable container of Figure 1;

15 Figure 8 is a plan view of still yet another embodiment of an active microwave energy heating element for the microwavable container of Figure 1;

Figure 9 is a perspective view of another embodiment of a tray for the microwavable container of Figure 1;

Figure 10 is a perspective view of yet another embodiment of a tray for the microwavable container of Figure 1;

20 Figures 11a to 11c are graphs showing three-dimensional surface temperature profiles of food products cooked in a conventional oven and in a microwave oven and supported by a number of microwavable containers including the microwavable container of Figure 1; and

25 Figure 12 is a top plan view of an active microwave energy heating insert in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

30 Referring now to Figures 1 to 5, an embodiment of a microwavable container is shown and is generally indicated to by reference numeral 10. The container 10 includes a generally rectangular outer carton 12 and an inner tray 14 arranged to carry a food product preferably in the form of a pie having a crust. The

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carton 12 is folded from a paperboard blank and has top and bottom major panels 20, 22 interconnected by side panels 24. Side flaps 26 extend about the edges of the major panels 20, 22 and about the side panels 24. The side flaps 26 can be folded to seal the carton 12. The exact details of the carton and paperboard blank will vary according to the food product dimensions and characteristics of the carton and are provided for illustrative purposes only.

The top major panel 20 of the carton 12 supports an active microwave energy heating element 28 best seen in Figures 2 and 3. The active microwave energy heating element 28 is bonded or adhered to the inwardly directed face of the top panel 20 so that the active microwave energy heating element 28 overlies the inner tray 14 when the tray is inserted into the carton 12.

The active microwave energy heating element 28 includes a substrate 30 formed of suitable material such as for example, polymeric film, paper or paperboard. A pattern 32 of microwave energy interactive material is disposed on the substrate 30. The microwave energy interactive material may be electroconductive or semiconductive material such as for example metal foil, vacuum deposited metal or metallic ink. In the case of electroconductive material, aluminum is preferred although other metals such as copper may be employed. In addition, the electroconductive material maybe replaced with a suitable electroconductive, semiconductive or non-conductive artificial dielectric or ferroelectric. Artificial dielectrics comprise conductive subdivided material in a polymeric or other suitable matrix or binder and may include flakes of electroconductive metal such as aluminum. Alternatively, the microwave energy interactive material may be in the form of a patterned susceptor including one or more layers ofsuscepting material. In the present embodiment, the microwave energy interactive material is in the form of metal foil.

As best illustrated in Figure 2, the pattern of microwave energy interactive material includes an outer thick ring 34 defining a central aperture 36. Within the aperture 36 is an array 38 of islands 40. For the most part, the islands 40 in the array 38 are generally hexagonal in shape although near the corners and along the sides of the array, the islands 40 take different shapes. Specifically, in

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the present example, at each corner of the array 38, is a group 42 of hexagonal rings 44 surrounding circular islands 46. The hexagonal rings 44 are arranged in two small rows and are surrounded along one side by smaller islands 47 shaped to fill in the spaces between the hexagonal rings 44 and the hexagonal islands 40.

5 Partial hexagonal islands 48 are positioned along the sides of the array where there is insufficient room for complete hexagonal islands.

A susceptor 50 including at least one layer of suscepting material overlies the microwave energy interactive material and substrate 30. The susceptor 50 produces a heating effect upon excitation by incident microwave energy as is well known. The susceptor may be in the form of a printed ink or alternatively a coating sputtered or evaporated over the substrate 30 and microwave energy interactive material. Susceptor 50 may not be utilized or additional layers of suscepting material may be provided depending upon the heating effect required. If the susceptor 50 is not used, a plain polymeric film will typically be used in its place.

As a principal form of control, the rings and islands are reactive with the incident microwave energy so that their nature and the extent of their coverage of the top panel 20 of the carton 12 determines the amount and distribution of energy transmitted to the upper surface of the food product carried by the inner tray 14. The islands principally prevent transmission of microwave energy but they also provide a local excitation at their outer edges. Therefore, the islands enhance the excitation of the susceptor to increase its effect. The spacing between the islands and rings and their sizes are selected to control the transmission and distribution of energy to the food product to avoid charring of the food product while ensuring the upper surface of the food product is browned as desired.

Referring now to Figure 4, the inner tray 14 is better illustrated. As can be seen, similar techniques to those used with respect to the active microwave energy heating element 28 on the outer carton 12 are used on the inner tray. Inner tray 14 includes a bottom wall 60 and upstanding major and minor side walls 62 about the periphery of the bottom wall. The side walls 62 terminate in an outwardly extending rim 64. Tabs 66 extend from the side walls 62 through

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apertures 68 in the rim 64 and are folded and bonded to the rim 64 to enhance the structural integrity of the inner tray 14. The inner tray 14 in this example is constructed from a paperboard blank best seen in Figure 5 although it should be realized that the tray may be press-formed.

5 An active microwave energy heating element 70 is bonded or adhered to the interior surfaces of the bottom and side walls 60 and 62 respectively. Similar to the active microwave energy heating element 28, active microwave energy heating element 70 is in the form of a laminate including a substrate on which a pattern of microwave energy interactive material is disposed. A susceptor including
10 at least one layer of susceptor material overlies the pattern of microwave energy interactive material and the substrate so that the susceptor is positioned between the active microwave energy heating element 70 and a food product carried by the inner tray 14. The susceptor may not be utilized or additional layers of susceptor material may be provided depending upon the heating effect required. If the
15 susceptor is not used, a plain polymeric film will typically be used in its place.

 In this particular example, the pattern of microwave energy interactive material on the bottom wall includes a generally rectangular ring 72 about the peripheral margin of the bottom wall. Within the rectangular ring 72 are two large meandering open loops 74 which generally resemble maple leaves. The
20 meandering loops 74 are coupled to the rectangular ring 72 by a pair of bridges 76. The length of each meandering loop 74 is preferably close to an integer of the wavelength of the incident microwave energy. In this specific example, each meandering loop has a length which is equal to approximately 5λ where λ is the effective wavelength of the incident microwave energy projected onto the surface of
25 the active microwave energy heating element 70. By using large multi-wavelength meandering loops and providing tight bends in the loops, which may be used to increase localized capacitance, better and more uniform heating of a central region of the food product is achieved.

 Surrounding the meandering loops 74 on both the inside and the
30 outside thereof are a plurality of loops 78 and islands 80. The loops 78 are in the form of annular rings surrounding smaller circular islands. The islands 80 are

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provided at various locations and are shaped to conform with surrounding islands or loops so that a generally even spacing between adjacent islands and loops exists.

The sizes of the loops and islands are chosen to achieve the desired cooking result. For example, the sizes of the loops and islands may be selected to be sufficiently small so that the loops 78 and islands 80 are decoupled from the large meandering loops 74 and therefore, contribute very little to the heating effect produced by the active microwave energy heating element 70. Alternatively, the sizes of the loops and islands may be selected to be sufficiently large to contribute to the heating effect.

The inner surface of each side wall 62 is also coated with microwave energy interactive material. A plurality of spaced elongate slots 82 are formed in the microwave energy interactive material on each side wall. The elongate slots are sized and shaped to promote localized fields adjacent thereto and enhance excitation of the susceptor to promote browning of the food product held by the inner tray when exposed to incident microwave energy.

The arrangement of the slots 82 formed in the pattern of microwave energy interactive material on each major side wall is the same. As can be seen, at the end of each major side wall 62 are two pair of laterally spaced curved slots 84 arranged to form a generally U-shaped configuration. Between each U-shaped configuration is a generally horizontal slot 86 having cambered major edges. Centrally located on each major side wall is another configuration of slots. This configuration includes a stack of vertically spaced, generally U-shaped slots 88. The bottom slot in the stack is inverted. On each side of the stack is a pair of laterally spaced, generally upright slots 90 and 92. Both slots have cambered major edges. The interior slots 92 have inturned ends. Each of the slots formed in the microwave interactive material has bulbous ends to even out the field strength along the lengths of the slots.

The arrangement of the slots 82 formed in the microwave energy interactive material on each minor side wall 62 is the same but the patterns are different than those on the major side walls. At the end of each minor side wall is a pair of vertically spaced curved slots 94, each having bulbous ends. Above the pair

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is a generally horizontal slot 96 having one upright end and an opposite gradually curved end. Centrally located on each minor side wall is a stack of vertically spaced, generally U-shaped slots 98. The bottom two slots in the stack are shallow and have bulbous ends. The stack of slots is positioned above a generally horizontal slot 100 having cambered major sides and bulbous ends. On each side of the stack is an angled slot 102 having downturned ends that are bulbous.

The slots formed in the microwave energy interactive material adjacent the corners of the inner tray 14 curve upwardly to enhance browning of the food product adjacent the corner regions of the inner tray. The bulbous ends of the majority of the slots further assist in the heating effect. Although a particular arrangement of slots has been shown, those of skill in the art will appreciate that other various arrangements can be used depending on the heating effect desired.

Referring now to Figure 5, the blank used to construct the inner tray 14 is better illustrated. The blank includes a generally rectangular central panel 103 constituting the bottom wall and four generally rectangular peripheral panels 104 joined to a respective edge of the central panel by score lines 105. The peripheral panels 104 constitute the side walls of the inner tray. Intermediate panels 105 bridge the peripheral panels at the corners of the blank and have bisecting score lines 107 thereon. A tab 66 is formed along the outer edge of each intermediate panel.

When the inner tray 14 is to be constructed from the blank, the rectangular panels 104 are folded upwardly about the score lines 105. The bisecting score lines 107 and the intermediate panels 106 are folded in a direction away from the interior of the inner tray 14. The intermediate panels 105 are then folded to overlie a side wall so that the tabs 66 can pass through the apertures 68 in the rim 64. The tabs are then be folded to overlie the rim.

Referring to Figure 6, another embodiment of an active microwavable heating element to be supported on the inwardly directed surface of the top major panel 20 of the inner carton 12 and to overlie the inner tray 14 is shown. In this embodiment, like reference numerals will be used to indicate like components of the previous embodiment with a "100" added for clarity. Similar to

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the active microwave energy heating element 28, active microwave energy heating element 128 includes a pattern of microwave energy interactive material 132 disposed on a substrate. A susceptor including at least one layer ofsuscepting material overlying the microwave energy interactive material and the substrate may be utilized. If the susceptor is not used, a plain polymeric film will typically be used in its place. The pattern of microwave energy interactive material includes an outer thick ring 134 defining a central aperture 136. Within the aperture 136 is an array 138 of loops 144. Each loop 144 is in the form of a circular ring surrounding a circular island 146.

Referring now to Figure 7, yet another embodiment of an active microwave heating element to be supported on the inwardly directed surface of the top major panel 20 of the inner carton 12 and to overlie the inner tray 14 is shown. In this embodiment, like reference numerals will be used to indicate like components of the first embodiment with a "200" added for clarity. As can be seen, the pattern of microwave energy interactive material includes an outer thick ring 234 defining a central aperture 236. Within the aperture 236 is an array 238 of circular islands 240. A susceptor including at least one layer ofsuscepting material overlying the microwave energy interactive material and the substrate may be utilized. If the susceptor is not used, a plain polymeric film will typically be used in its place.

Referring now to Figure 8, still yet another embodiment of an active microwave energy heating element 328 to be supported on the inwardly directed surface of the top major panel 20 of the inner carton 12 and to overlie the inner tray 14 is shown. In this embodiment, like reference numerals will be used to indicate like components of the first embodiment with a "300" added for clarity. As can be seen, the pattern of microwave energy interactive material includes an outer thick rectangular ring 334 defining a central aperture 336. A susceptor including at least one layer ofsuscepting material overlying the microwave energy interactive material and the substrate may be utilized.

Referring now to Figure 9, another embodiment of an inner tray 414 very similar to that of the first embodiment is shown. In this embodiment, like

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reference numerals will be used to indicate like components of the first embodiment with a "400" added for clarity.

As can be seen, the active microwave energy heating element 470 is very similar to that of the first embodiment. However, unlike the first embodiment, the pattern of microwave energy interactive material on the bottom wall 460 only includes a rectangular ring 472 and two large meandering open loops 474 coupled to the ring 472 by bridges 476. In this embodiment, the loops 78 and islands 80 are removed from the substrate.

Referring now to Figure 10, still yet another embodiment of an inner tray 514 is shown. Similar to the previous embodiments, an active microwave energy heating element is bonded or adhered to the interior surfaces of the bottom and side walls 560 and 562 respectively. As can be seen, the pattern of microwave energy interactive material on the bottom wall 560 includes a rectangular ring 572 positioned about the peripheral margin of the bottom wall. Two concentric octagonal rings 574 and 576 respectively are centrally positioned on the bottom wall. The outer octagonal ring 576 is joined to the rectangular ring 572 by a pair of bridges 578. The inner octagonal ring 574 is joined to the outer octagonal ring 576 by two pair of diverging bridges 580.

Generally rectangular rings 582 are positioned adjacent opposed ends of the bottom wall and are spaced slightly from the rectangular ring 572. Each ring 582 has a major transverse leg 584 and a major generally concave leg 586. The two major legs are joined by a plurality of spaced bridges 588.

A plurality of spaced elongate slots 590 are formed in the microwave energy interactive material on each side wall 562. The elongate slots are arranged in staggered rows with the slots in row nearest the bottom wall being more elongate than those in other rows. The elongate slots are sized to promote localized fields to enhance the susceptor and promote browning of the food product held by the container when penetrated by microwave energy.

In the embodiments described above, the microwavable container is described as having an active microwave energy heating element bonded or adhered to the outer container to overlie the tray. Those of skill in the art will appreciate

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that the active microwave energy heating on the top major panel may be free-floating and inserted into the carton 12 and rest on the tray 14 above the food product. It also should however be appreciated that the trays may be used alone with or without a lid. If a lid is to be included, the lid may also be in the form of a polymeric film, metal foil or a susceptor. It should also be appreciated that although the described embodiments show the pattern of microwave energy interactive material being covered with a susceptor, the susceptor is optional.

Referring now to Figure 12, an active microwave energy heating insert is shown and is generally indicated to by reference numeral 700. The insert 700 includes a paperboard substrate 702 on which an active microwave energy heating element is bonded or adhered. The active microwave energy heating element includes a pattern of microwave energy interactive material which may or may not be covered with a susceptor. The pattern of microwave energy interactive material is similar to that on the bottom wall of the tray illustrated in Figure 9. Specifically, the pattern of microwave energy interactive material includes a thick generally rectangular ring 704 about the peripheral margin of the insert defining a central aperture 706. Within the aperture are two large meandering open loops 708. The open loops 708 are coupled to the rectangular ring by bridges 710. The insert 700 is designed to be placed under a conventional microwavable container to enhance the heating effect so that the food product in the conventional microwavable container is more uniformly heated when cooked.

Although the embodiments of Figures 4, 9 and 12 show an active microwave energy heating element including a pair of large meandering loops, it should be apparent to those of skill in the art that one large meandering loop or more than two meandering loops may be utilized depending on the heating effect desired.

Example

This Example illustrates the beneficial effect obtained using the microwavable container 10 of the present invention.

A 1 kg chicken pot pie was placed in a foil container (sample #1), in

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a conventional microwavable container (sample #2) and in a microwavable container constructed in accordance with the present invention as shown in Figures 1 to 5 (sample #3). Sample #1 was cooked in a conventional oven for 75 minutes. Samples #2 and #3 were exposed to microwave energy for 20 minutes. The pie top, side walls and bottom of each sample were evaluated. The temperature profiles of the cooked samples were also determined.

The results obtained are set forth in Figures 11a to 11c. It will be seen from these Figures that by employing the microwavable container structure of the present invention and especially that illustrated in Figures 1 to 5, the core temperature of the cooked sample is significantly increased as compared to sample #2 cooked in a microwave oven for a similar duration. The pie crust was also dry and browned unlike sample #2. The only comparable sample was sample #1 but that sample required a total preparation time of 90 minutes, 15 minutes to prewarm the oven and 75 minutes to cook the sample, a significantly longer duration.

Summary

As those of skill in the art will appreciate, the present invention provides for a novel microwavable container for food products and specifically pies which generally uniformly heats the pie while browning and drying the pie crust. Those will also appreciate that variations and modifications may be made to the present invention without departing from the scope thereof as defined by the appended claims.

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WE CLAIM:

1. A microwavable container comprising:

an outer sleeve;

5 an inner tray within said sleeve and having a bottom wall and at least one upstanding side wall about the periphery of said bottom wall;

a first active microwave energy heating element within said sleeve and disposed opposite said tray; and

10 a second active microwave energy heating element on said tray, said second microwave energy heating element having patterns of microwave energy interactive material on the bottom and side walls of said tray configured to permit a controlled degree of penetration of incident microwave energy through said bottom wall to channel microwave energy towards a central region of said tray and to promote browning of a food product carried by said tray about the periphery thereof.

15 2. A microwavable container as defined in claim 1 wherein the microwave energy interactive material on said side walls has a plurality of slots formed therein.

20 3. A microwavable container as defined in claim 2 wherein the slots adjacent the corners of said tray are curved to enhance browning of the food product in the corner regions of said tray.

25 4. A microwavable container as defined in claim 3 wherein opposed ends of at least some of said slots are bulbous.

30 5. A microwavable container as defined in claim 4 further comprising at least one layer of susceping material on said at least one upstanding side wall and overlying said microwave energy interactive material.

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6. A microwavable container as defined in claim 5 further comprising at least one layer of suscepting material on said bottom wall and overlying said microwave energy interactive material.

5 7. A microwavable container as defined in claim 1 wherein said pattern of microwave energy interactive material on said bottom wall includes at least one meandering loop.

10 8. A microwavable container as defined in claim 7 wherein the length of said at least one meandering loop is approximately equal to an integer multiple of the effective wavelength of the incident microwave energy.

15 9. A microwavable container as defined in claim 8 wherein said pattern of microwave energy interactive material on said bottom wall further includes a ring about the peripheral edge of said bottom wall and wherein said at least one meandering loop is open, said loop being coupled to said ring by bridges.

20 10. A microwavable container as defined in claim 9 wherein said pattern of microwave energy interactive material on said bottom wall further includes a plurality of spaced loops and islands.

25 11. A microwavable container as defined in claim 1 wherein said first active microwave energy heating element includes a pattern of microwave energy interactive material, said pattern including a ring about the periphery of said microwave energy heating element and defining a centrally located aperture.

30 12. A microwavable container as defined in claim 11 wherein said pattern of microwave energy interactive material further includes an array of microwave energy interactive elements within said aperture.

13. A microwavable container as defined in claim 12 wherein said

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microwave energy interactive elements are in the form of circular or hexagonal islands.

5 14. A microwavable container as defined in claim 12 wherein said microwave energy interactive elements are in the form of loops, each of said loops surrounding an island.

10 15. A microwavable container as defined in claim 2 wherein said elongate slots are arranged in rows.

16. A microwavable container as defined in claim 15 wherein said rows of slots are staggered.

15 17. A microwavable container as defined in claim 16 further comprising at least one layer of susceping material on said at least one upstanding side wall and overlying said microwave energy interactive material.

20 18. A microwavable container as defined in claim 17 further comprising at least one layer of susceping material on said bottom wall and overlying said microwave energy interactive material.

25 19. A microwavable container as defined in claim 1 wherein said pattern of microwave energy interactive material on said bottom wall includes a peripheral ring and centrally positioned, concentric octagonal rings coupled to said peripheral ring by bridges.

20. A microwavable container as defined in claim 19 wherein said concentric octagonal rings are coupled by pairs of diverging bridges.

30 21. A tray for a microwavable container comprising:
a bottom wall;

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at least one upstanding side wall about the periphery of said bottom wall; and

an active microwave energy heating element within said tray, said active microwave energy heating element having patterns of microwave energy interactive material on the bottom and side walls of said tray configured to permit a controlled degree of penetration of incident microwave energy through said bottom wall to channel microwave energy towards a central region of said tray and to promote browning of a food product carried by said tray about the periphery thereof.

22. A microwavable container as defined in claim 21 wherein said pattern of microwave energy interactive material on said bottom wall includes at least one meandering loop.

23. A microwavable container as defined in claim 22 wherein the length of said at least one meandering loop is approximately equal to an integer multiple of the effective wavelength of the incident microwave energy.

24. A microwavable container as defined in claim 22 wherein said pattern of microwave energy interactive material on said bottom wall further includes a ring about the peripheral edge of said bottom wall and wherein said at least one meandering loop is open, said loop being coupled to said ring by bridges.

25. A microwavable container as defined in claim 23 wherein said pattern of microwave energy interactive material on said bottom wall further includes a plurality of spaced loops and islands.

26. A microwavable container as defined in claim 21 wherein the microwave energy interactive material on said side walls has a plurality of slots formed therein.

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27. A microwavable container as defined in claim 26 wherein the slots adjacent the corners of said tray are curved to enhance browning of said food product in the corner regions of said tray.

5 28. A microwavable container as defined in claim 27 wherein opposed ends of at least some of said slots are bulbous.

10 29. A microwavable container as defined in claim 28 further comprising at least one layer of suscepting material on said at least one upstanding side wall and overlying said microwave energy interactive material.

15 30. A microwavable container as defined in claim 29 further comprising at least one layer of suscepting material on said bottom wall and overlying said microwave energy interactive material.

20 31. An active microwave energy heating insert to be placed under a microwavable container comprising:
a substrate; and
an active microwave energy heating element on said substrate, said active microwave energy heating element including a pattern of microwave energy interactive material thereon configured to permit a controlled degree of penetration of incident microwave energy therethrough to channel microwave energy towards a central region of a microwavable container thereon.

25 32. An active microwave energy heating insert as defined in claim 31 wherein said pattern of microwave energy interactive material includes at least one meandering loop.

30 33. An active microwave energy heating insert as defined in claim 32 wherein the length of said at least one meandering loop is approximately equal to an integer multiple of the effective wavelength of the incident microwave energy.

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34. An active microwave energy heating insert as defined in claim 33 wherein said pattern of microwave energy interactive material further includes a ring about the peripheral edge of said substrate and wherein said at least one meandering loop is open, said loop being coupled to said ring by bridges.

5

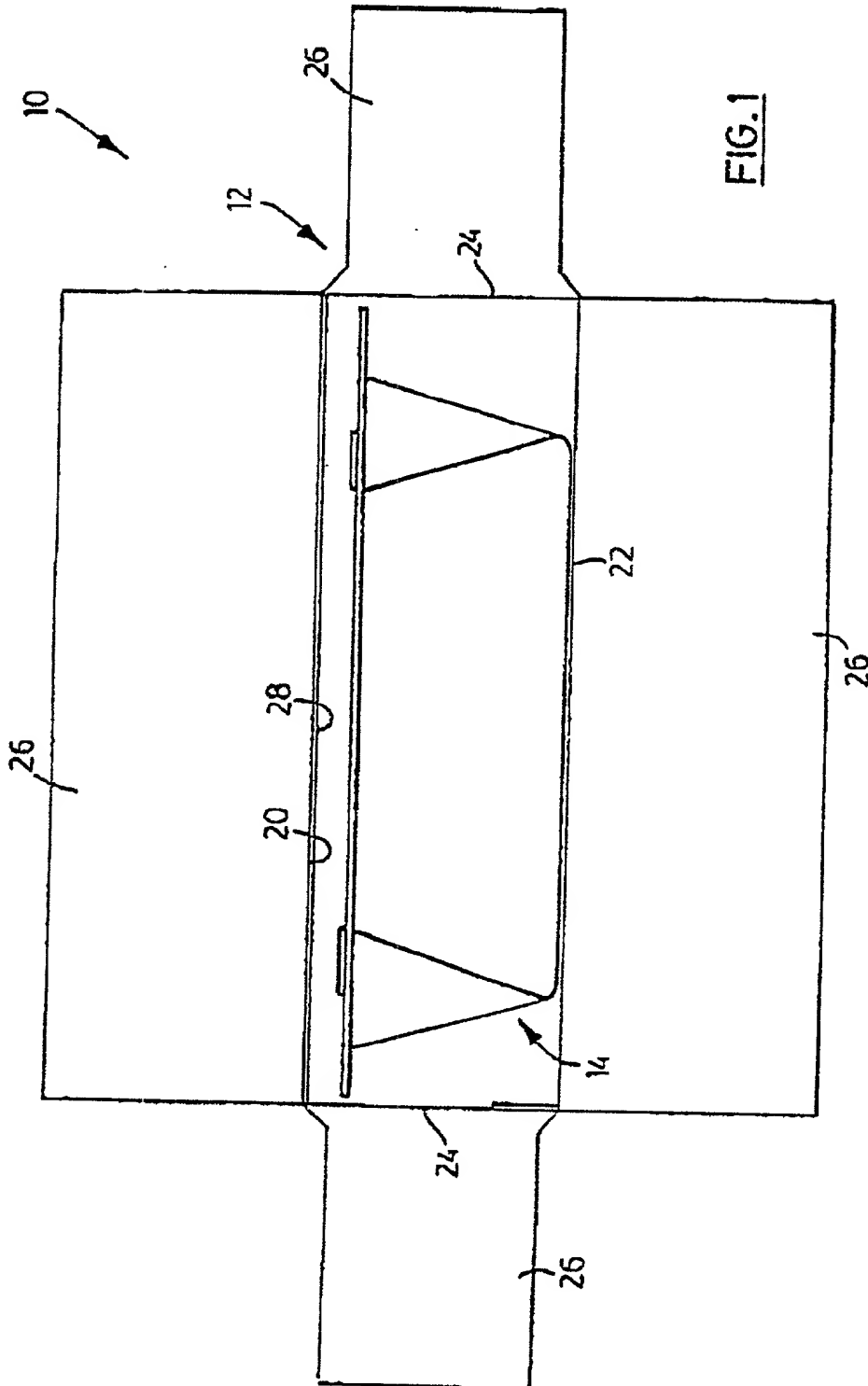
35. An active microwave energy heating insert as defined in claim 34 further comprising at least one layer of susceping material on said substrate and overlying said microwave energy interactive material.

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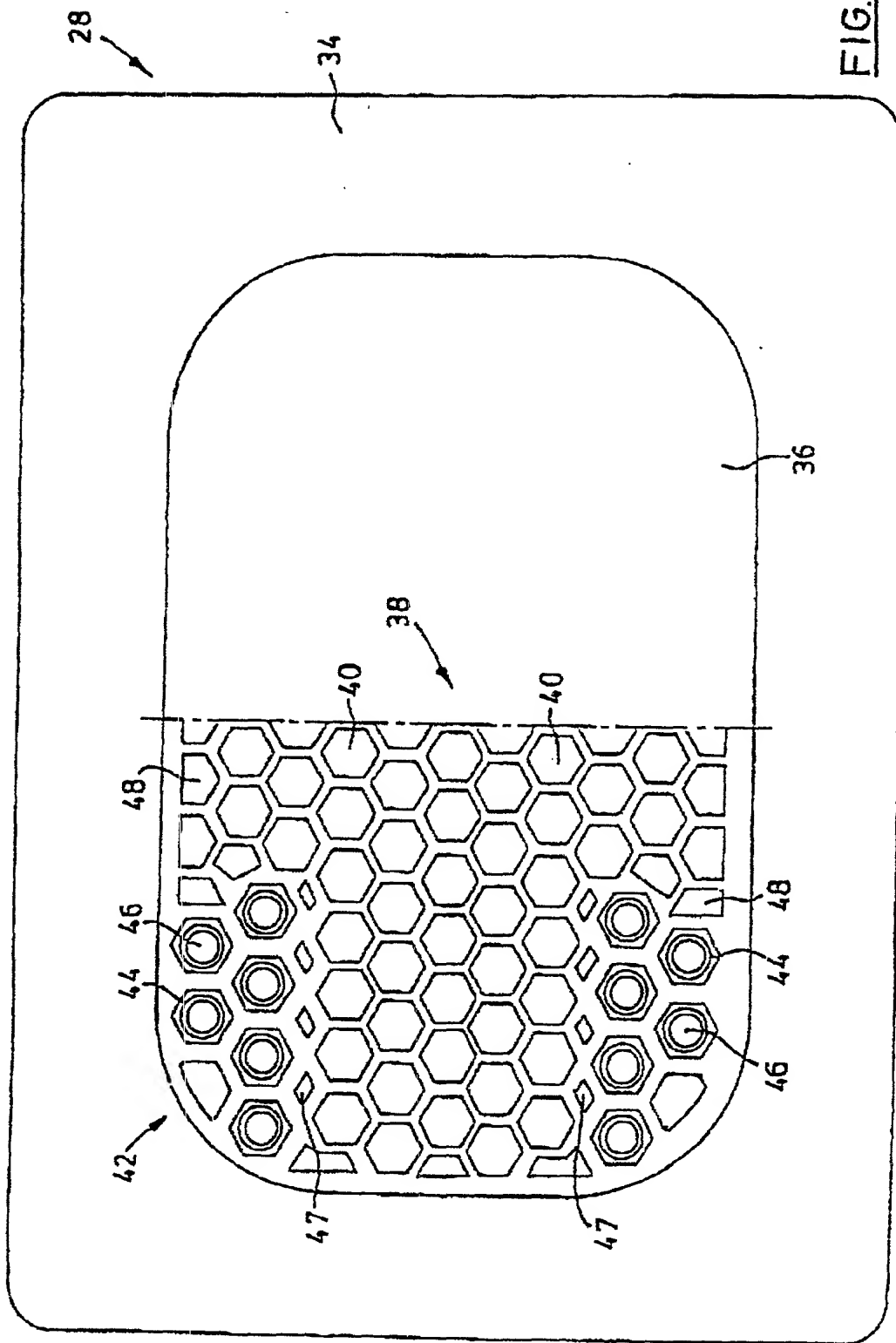


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FIG. 2



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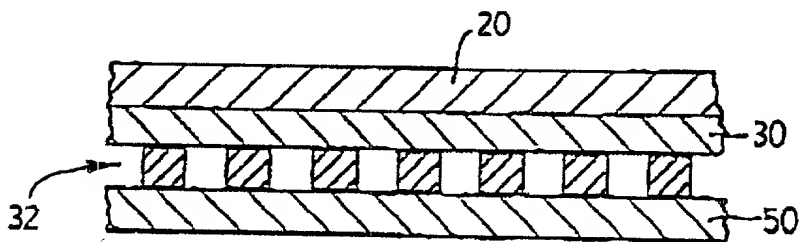
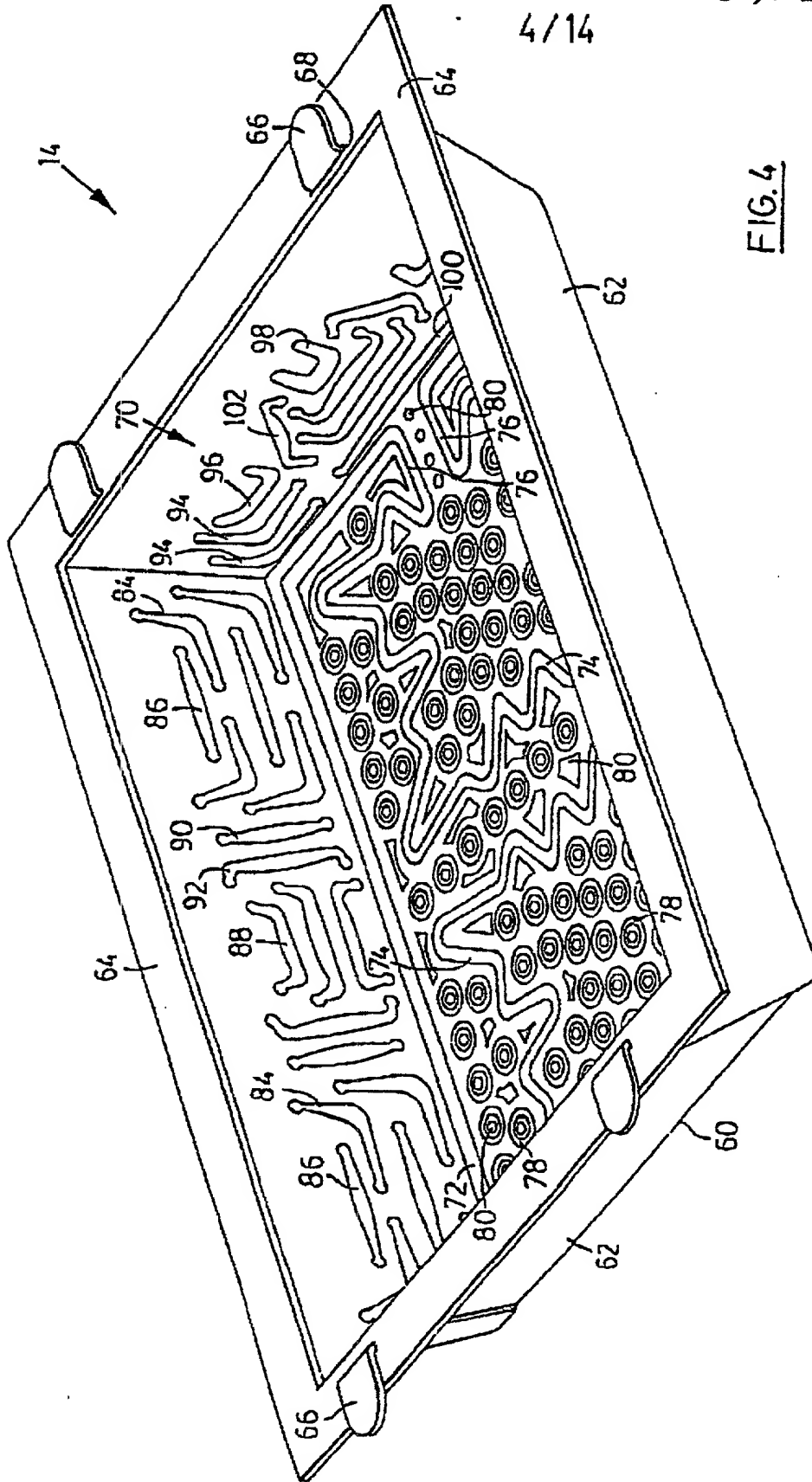


FIG. 3

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FIG. 4



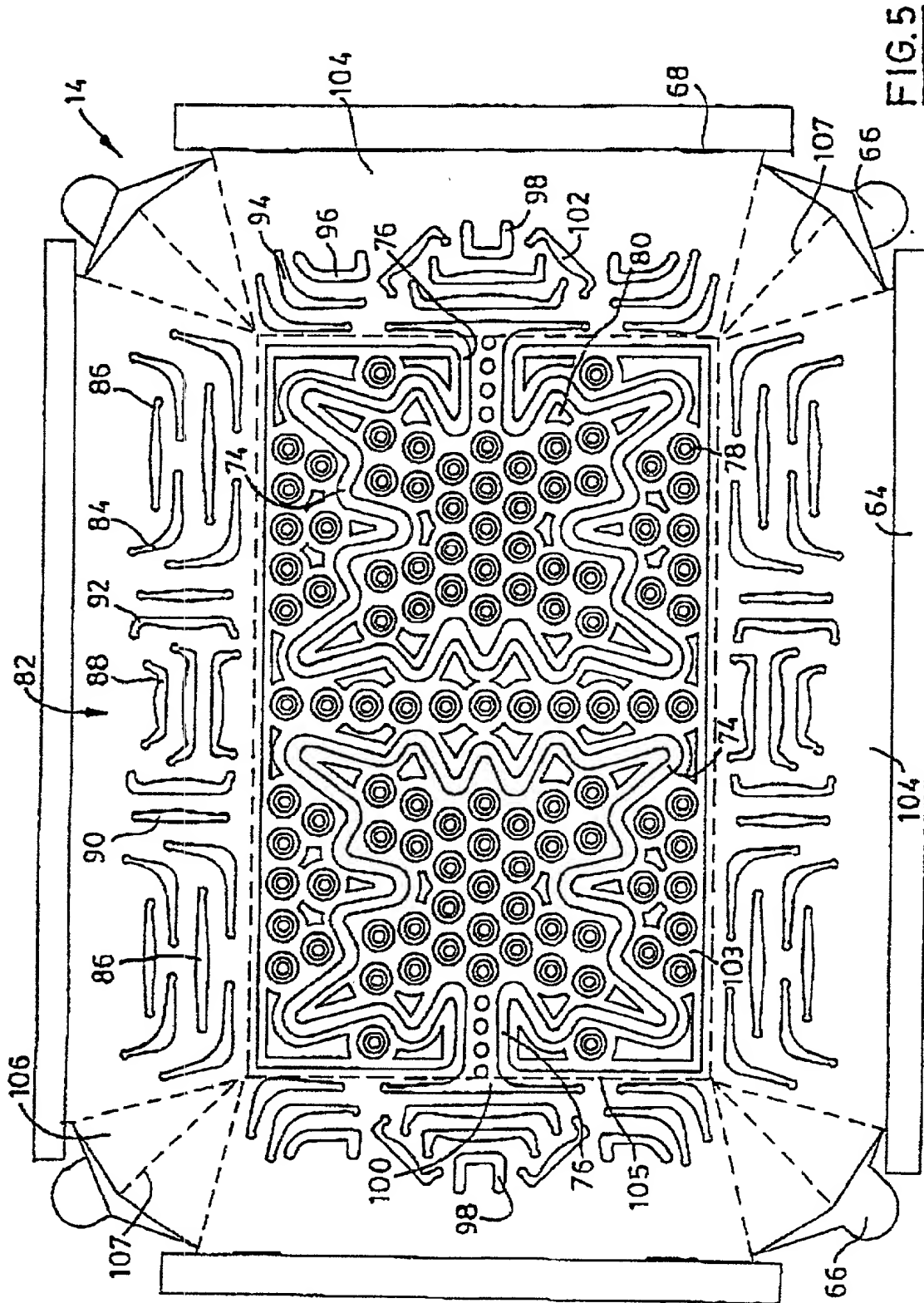
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FIG. 5

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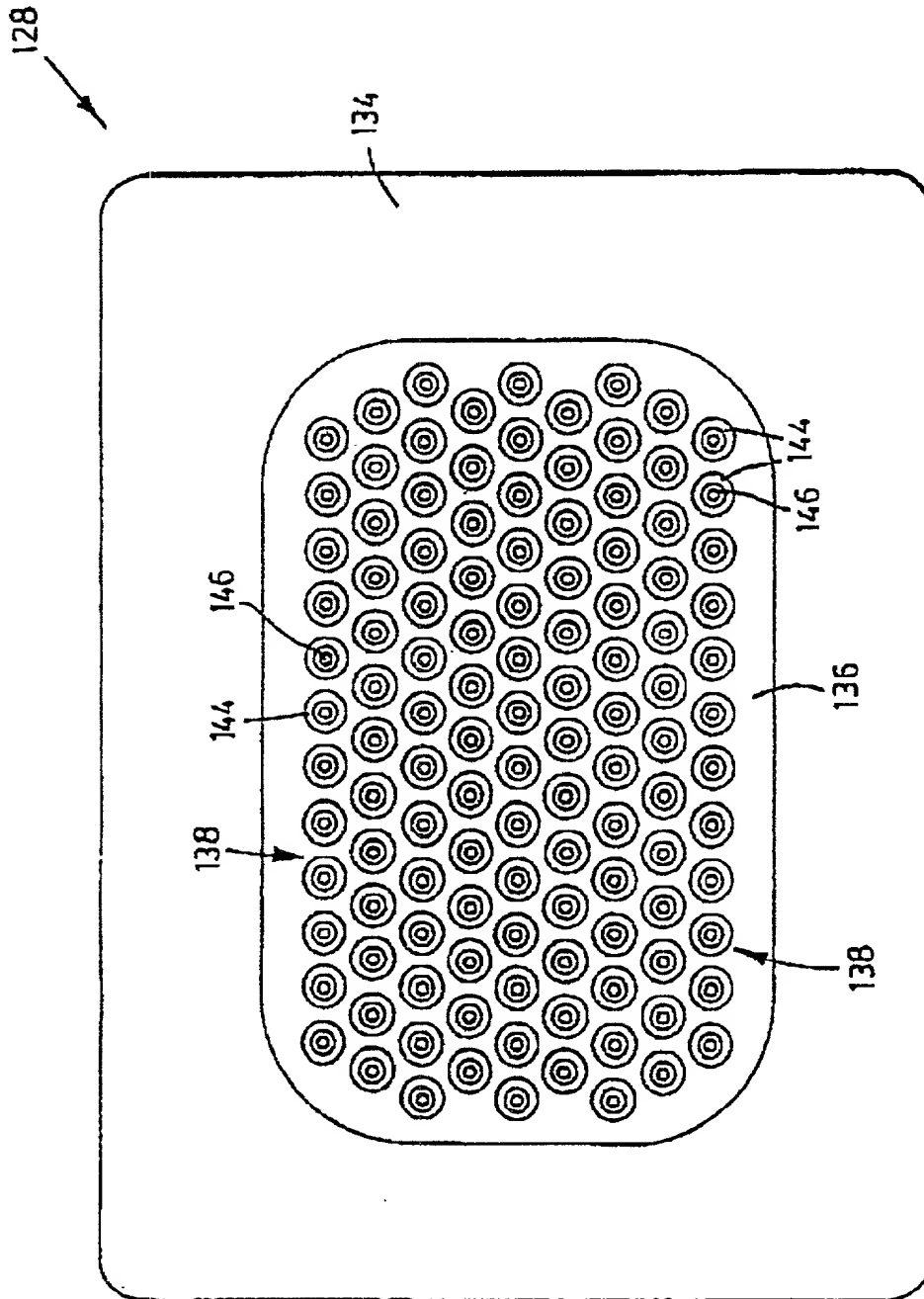


FIG. 6

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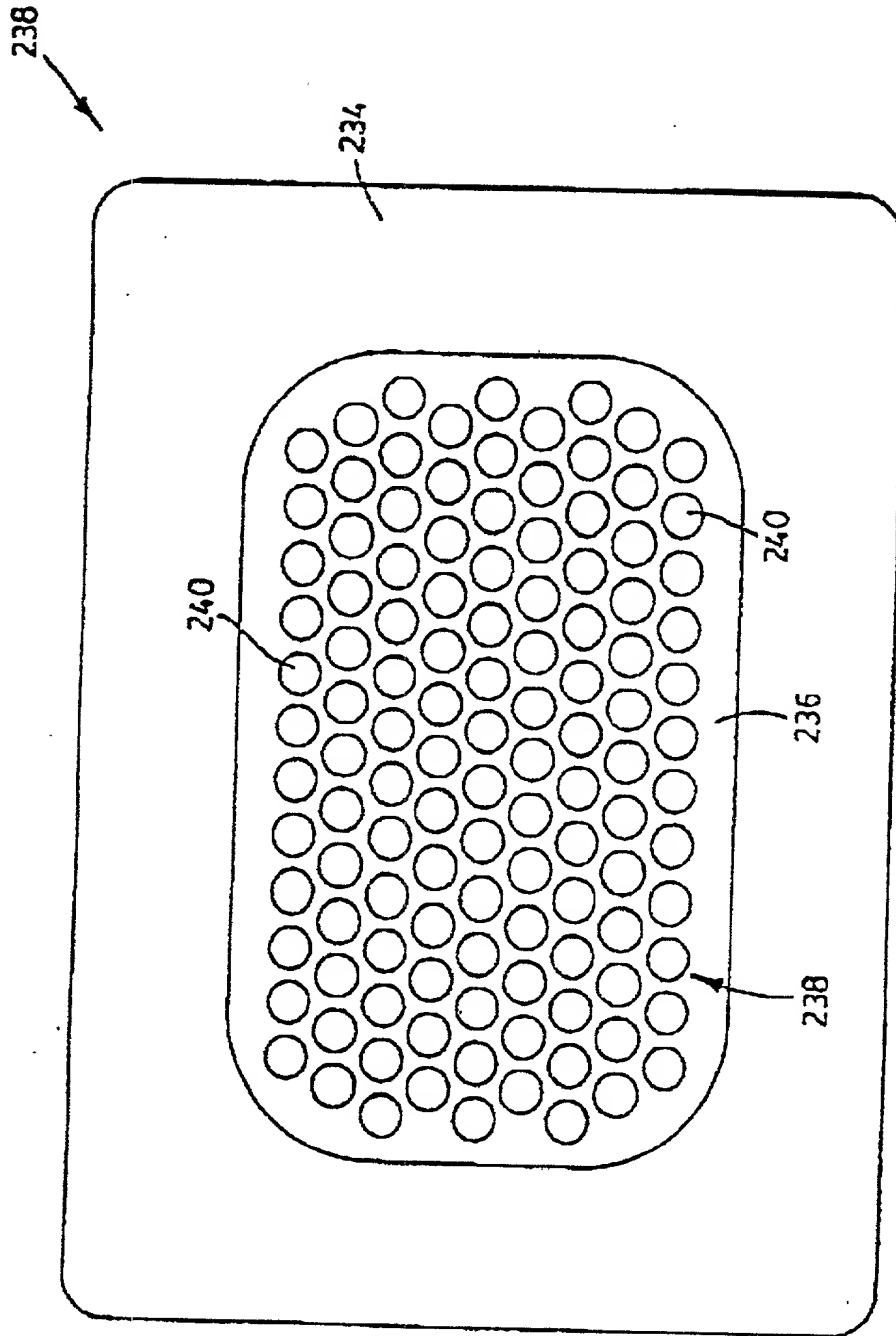


FIG. 7

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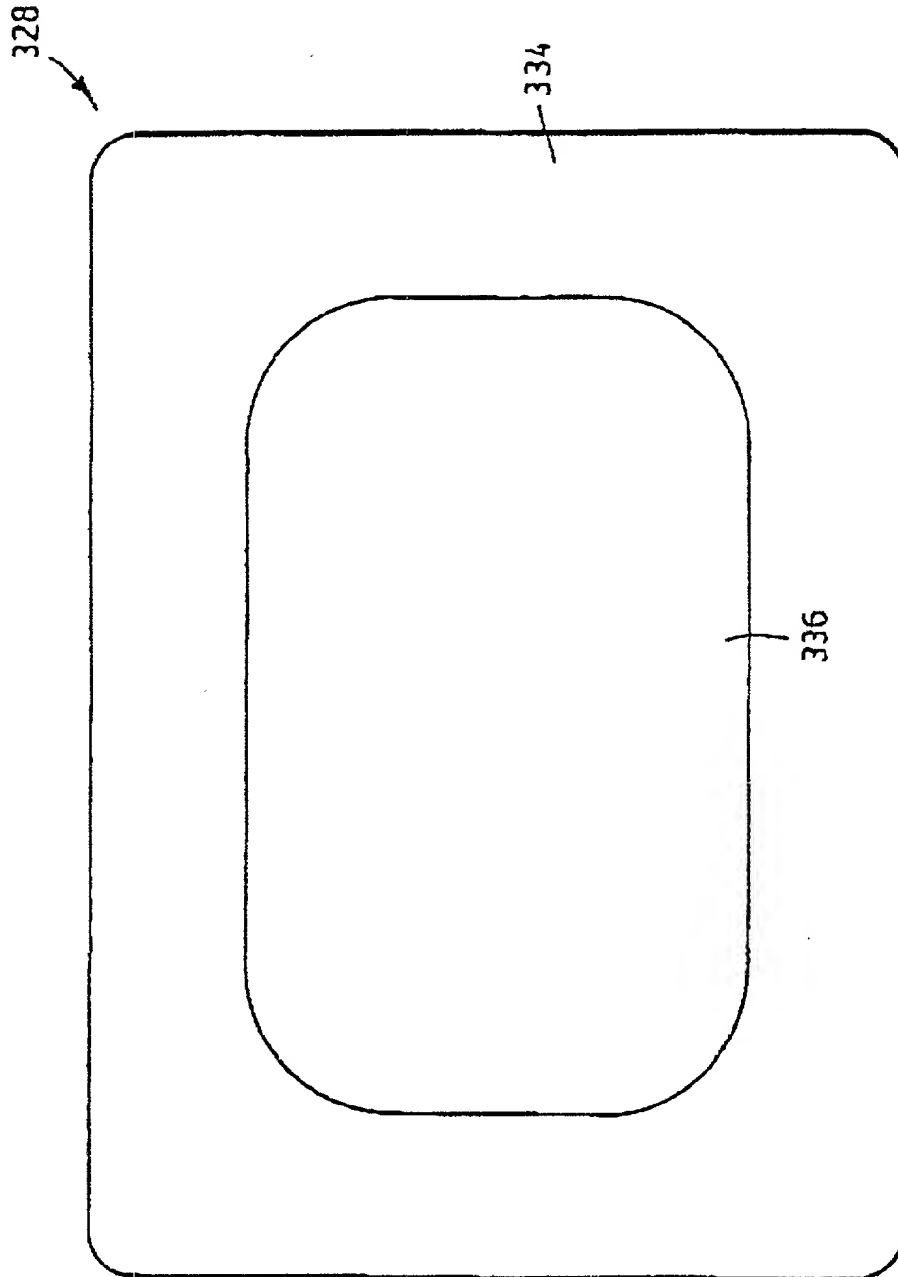
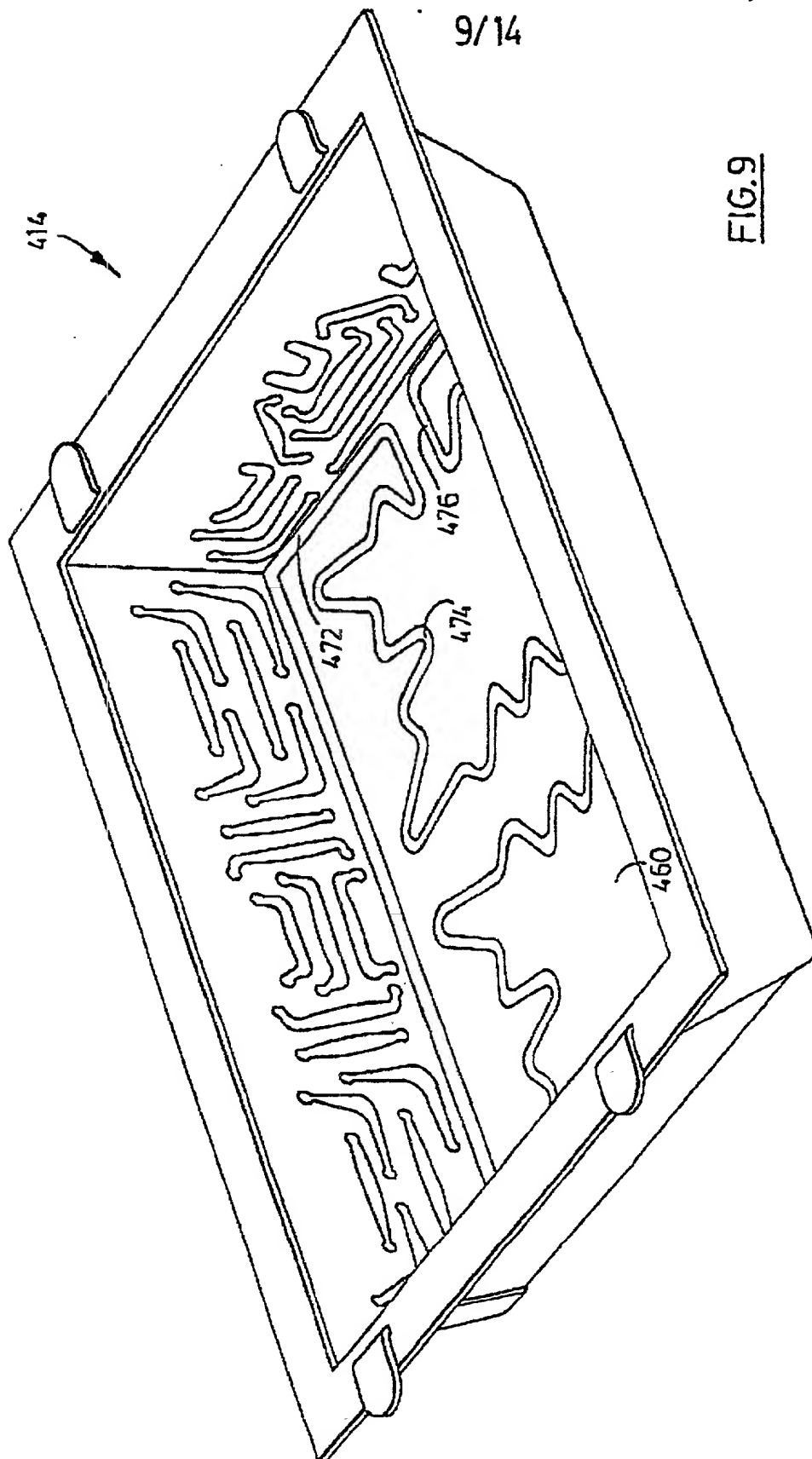


FIG. 8

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FIG. 9



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604290" 6604260

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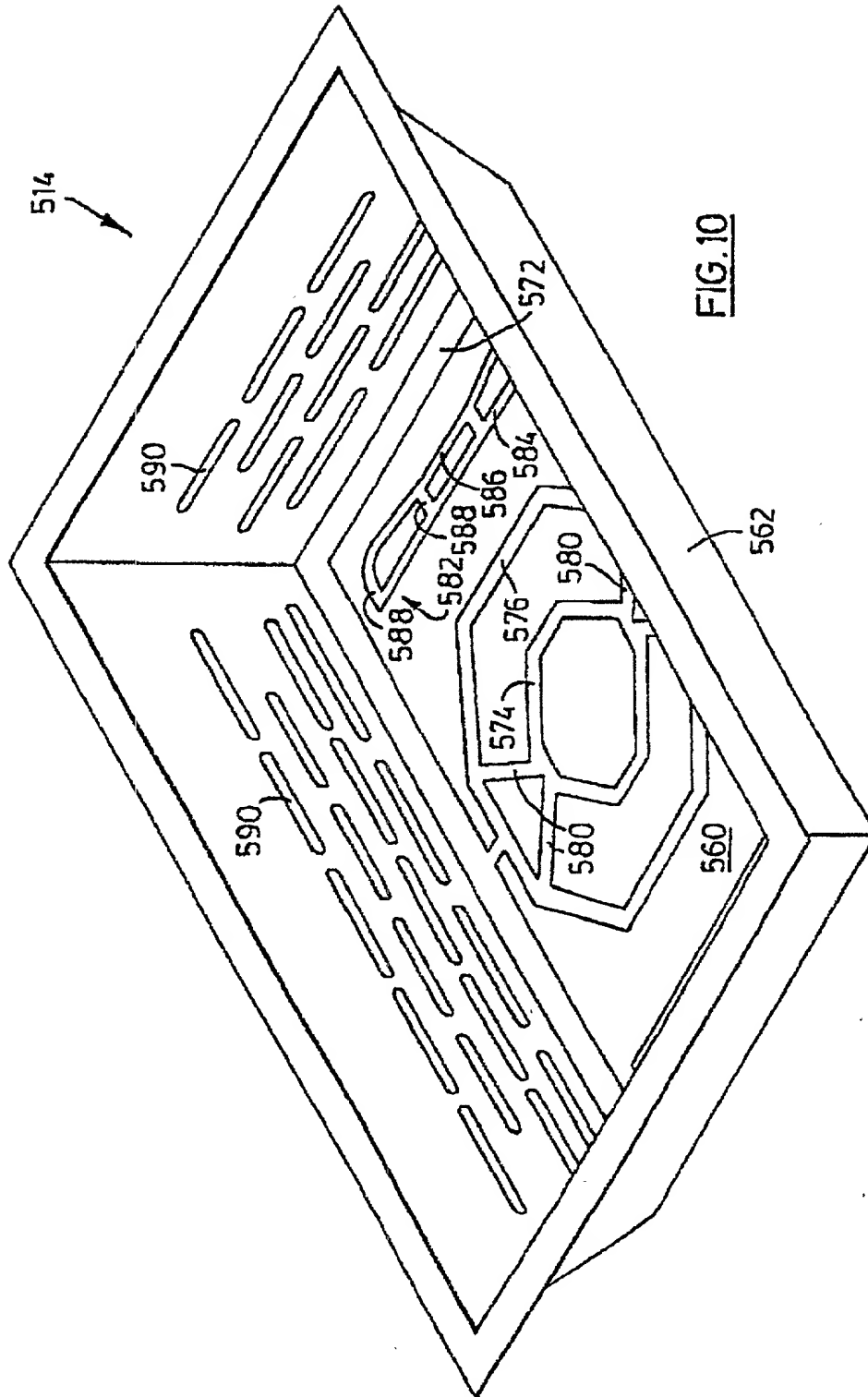


FIG. 10

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FCI/CAS/00000

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SAMPLE 1

1kg CHICKEN POT PIE TEST #: 6 LID DESIGN: NONE MICROWAVE OVEN: CONVENTIONAL
 DATA SUMMARY SHEET DATE: SEP-01 TRAY DESIGN: PROVIDED FOIL COOK TIME (MINUTES): 75.00

MOISTURE LOSS EVALUATION			
NET WT	INITIAL W	FINAL WT	% LOSS
1015	1032	1020	1.2 %

TOP CRUST EVALUATION			
	EDGE	MIDDLE	CENTRAL
% AREA	0.33	0.33	0.34
RATING	5	4	4
% A x R	1.65	1.32	1.36
TOTAL A x R	4.33		

RATING SCALE: 1 = SOGGY / MUSHY

	MAX	MIN	RANGE	AVE	ST. DEV.
CENTER	140	138	2	139.3	1.2
MIDDLE	166	147	19	153.5	8.4
PERIPHERA	206	175	31	189.4	8.2
OVERALL	206	138	68	172.8	21.0

GENERAL COMMENTS:

TOP EDGES BURNT

PROCEDURE COMMENTS:

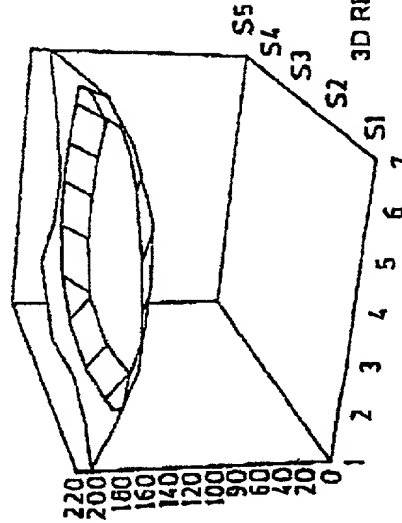
SIDE WALL EVALUATION			
	TOP	MIDDLE	BOTTOM
% AREA	0.33	0.33	0.34
RATING	5	4	4
% A x R	1.65	1.32	1.36
TOTAL A x R	4.33		

2 = SOFT 3 = BARELY DRY 4 = DRY

BOTTOM CRUST EVALUATION			
	EDGE	MIDDLE	CENTRAL
% AREA	0.33	0.33	0.34
RATING	4	4	4
% A x R	1.32	1.32	1.36
TOTAL A x R	4		

5 = DRY / FLAKY

TEMPERATURE PROFILE (F)						
206	186	175	177	182	194	201
195	160	149	148	151	166	189
188	150	138	140	140	153	181
194	158	147	147	151	162	181
184	194	184	182	187	194	201

FIG.11a

3D REPRESENTATION OF THE PIE INTERIOR
 TEMPERATURE PROFILE

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SAMPLE 2

1kg CHICKEN POT PIE TEST #: 4 LID DESIGN: NONE MICROWAVE OVEN: 14
DATA SUMMARY SHEET DATE: AUG-30 TRAY DESIGN: TRANSPARENT COOK TIME (MINUTES): 20.00

MOISTURE LOSS EVALUATION			
NET WT	INITIAL WT	FINAL WT	% LOSS
974	1076	1019	5.8 %

TOP CRUST EVALUATION			
	EDGE	MIDDLE	CENTRAL
% AREA	0.33	0.33	0.34
RATING	4	2	1
% A x R	1.32	0.66	0.34
TOTAL A x R	2.32		

RATING SCALE: 1 = SOGGY / MUSHY

	MAX	MIN	RANGE	AVE	ST. DEV.
CENTER	110	64	46	92.7	25.0
MIDDLE	130	99	31	112.8	11.0
PERIPHERA	204	178	25	192.3	7.7
OVERALL	204	64	140	156.5	43.5

GENERAL COMMENTS:
BOTTOM REGION SOGGY
PROCEDURE COMMENTS:

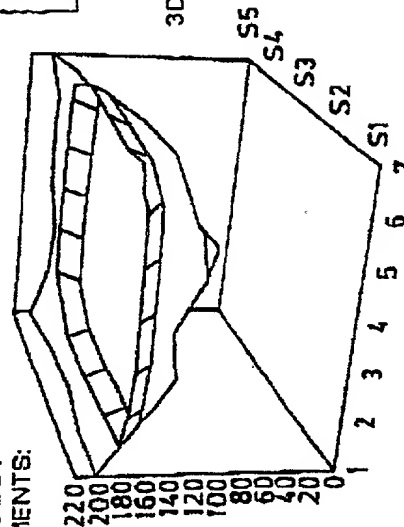
SIDE WALL EVALUATION			
	TOP	MIDDLE	BOTTOM
% AREA	0.33	0.33	0.34
RATING	4	3	2
% A x R	1.32	0.99	0.68
TOTAL A x R	2.99		

2 = SOFT 3 = BARELY DRY 4 = DRY

BOTTOM CRUST EVALUATION			
	EDGE	MIDDLE	CENTRAL
% AREA	0.33	0.33	0.34
RATING	2	2	2
% A x R	0.66	0.66	0.68
TOTAL A x R	2		

5 = DRY / FLAKY

TEMPERATURE PROFILE (F)										
204	189	179	183	182	185	189				
202	118	125	100	109	130	204				
195	99	104	64	110	116	200				
198	108	99	105	126	119	198				
201	188	184	190	191	189	189				



3D REPRESENTATION OF THE PIE INTERIOR
TEMPERATURE PROFILE

FIG. 11b

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SAMPLE 3

1kg CHICKEN POT PIE

TEST #: 200

DATE: JAN-11

DATA SUMMARY SHEET

MOISTURE LOSS EVALUATION			
NET WT	INITIAL W	FINAL WT	% LOSS
959	1053	924	13.5 %

TOP CRUST EVALUATION			
	EDGE	MIDDLE	CENTRAL
% AREA	0.33	0.33	0.34
RATING	5	4.5	5
% A x R	1.65	1.485	1.7
TOTAL A x R	4.84		

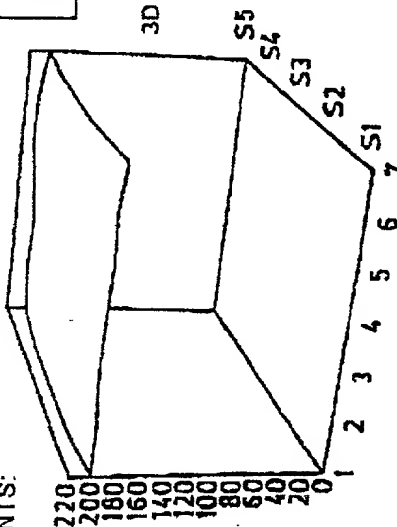
RATING SCALE: 1 = SOGGY / MUSHY

	MAX	MIN	RANGE	AVE	ST. DEV.
CENTER	208	207	1.08	207.1	0.8
MIDDLE	210	206	4.14	208.0	1.2
PERIPHERA	209	198	11.49	203.8	2.8
OVERALL	209.75	197.5	12.24	205.6	3.0

GENERAL COMMENTS:

NOT A VERY TIGHT FIT WITH THE TRAY.

PROCEDURE COMMENTS:



3D REPRESENTATION OF THE PIE INTERIOR
TEMPERATURE PROFILE

FIG. 11C

CCLDC49.L10
COTTBOX54MM
MICROWAVE OVEN:
TRAY DESIGN: CCTYWC8.L11
COOK TIME (MINUTES): 16
20.00

SIDE WALL EVALUATION			
	TOP	MIDDLE	BOTTOM
% AREA	0.33	0.33	0.34
RATING	5	3.5	5
% A x R	1.65	1.155	1.7
TOTAL A x R	4.505		

2 = SOFT 3 = BARELY DRY 4 = DRY

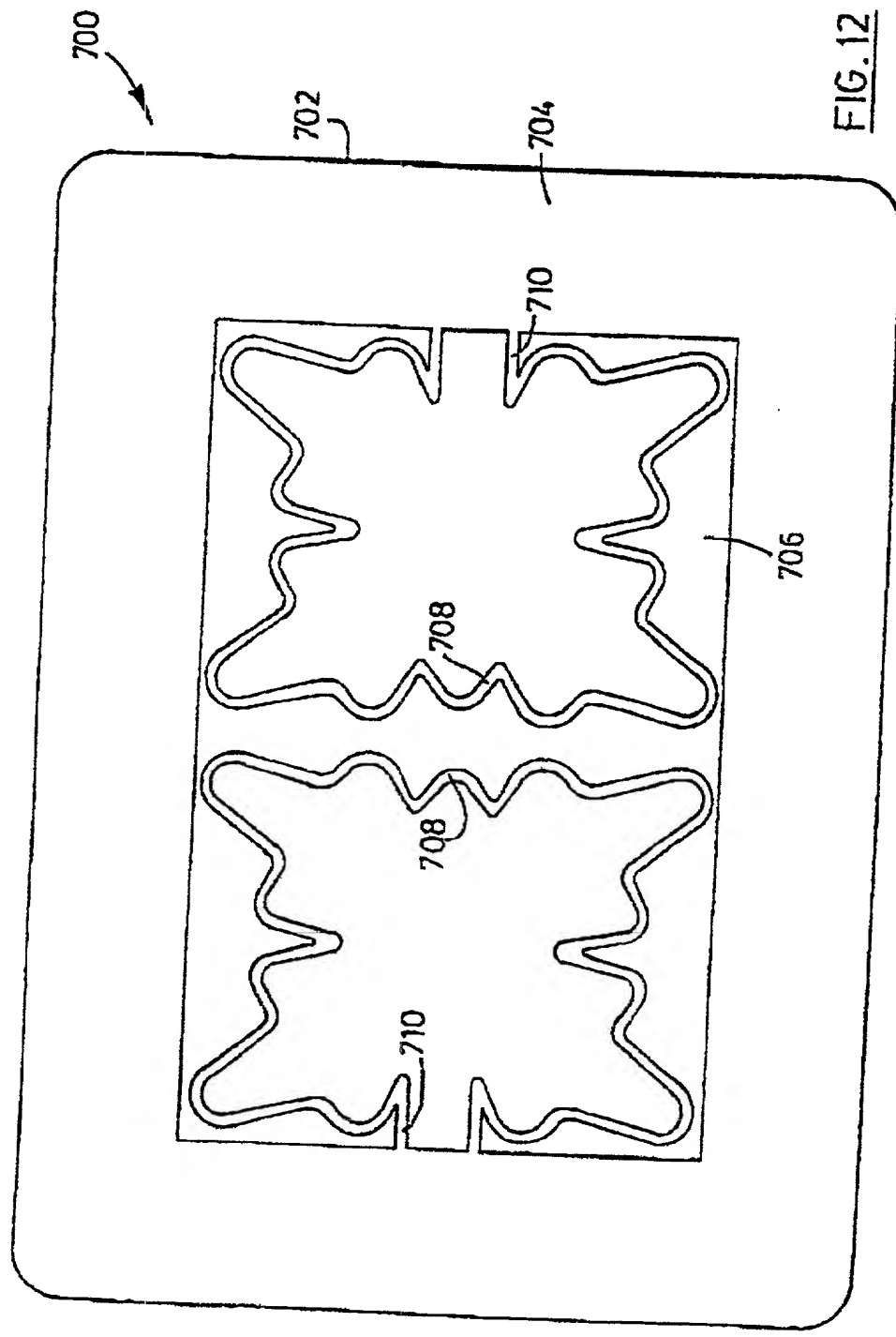
BOTTOM CRUST EVALUATION			
	EDGE	MIDDLE	CENTRAL
% AREA	0.33	0.33	0.34
RATING	4	4	3
% A x R	1.32	1.32	1.02
TOTAL A x R	3.68		

5 = DRY / FLAKY

TEMPERATURE PROFILE (F)											
202	201	203	203	201	203	198					
206	207	208	208	208	207	205					
207	209	207	207	208	207	205					
207	209	207	206	210	209	208					
202	204	202	205	209	207	202					

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

MICROWAVABLE CONTAINER

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application

Number _____

on _____

and was amended

on _____ (if applicable).

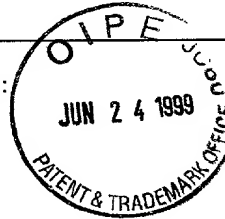
☐ was filed as PCT international application

Number PCT/CA97/00600

on 26 August 1997

and was amended under PCT Article 19

on _____ (if applicable).



I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 (a)-(e) of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. §119:

COUNTRY (if PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. §119
PCT	PCT/CA97/00600	26 August 1997	<u>X</u> Yes ___ No
U.S.	08/703,100	26 August 1996	<u>X</u> Yes ___ No
			___ Yes ___ No
			___ Yes ___ No
			___ Yes ___ No

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

(Application Number)

(Filing Date)

(Application Number)

(Filing Date)

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONTINUED)
(Includes Reference to Provisional and PCT International Applications)

ATTORNEY'S DOCKET NO.
013550-087

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose to the Office all information known to me to be material to the patentability as defined in Title 37, Code of Federal Regulations §1.56, which became available between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED
08/703,100	26 August 1996			
PCT APPLICATIONS DESIGNATING THE U.S.				
PCT APPLICATION NO.	PCT FILING DATE	U.S. APPLICATION NUMBERS ASSIGNED (if any)		
PCT/CA97/00600	26 August 1997			

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

39

William L. Mathis	17,337	George A. Hovanec, Jr.	28,223	Peter K. Skiff	31,917
Peter H. Smolka	15,913	James A. LaBarre	28,632	Richard J. McGrath	29,195
Robert S. Swecker	19,885	E. Joseph Gess	28,510	Matthew L. Schneider	32,814
Platon N. Mandros	22,124	R. Danny Huntington	27,903	Michael G. Savage	32,596
Benton S. Duffett, Jr.	22,030	Eric H. Weisblatt	30,505	Gerald F. Swiss	30,113
Norman H. Stepno	22,716	James W. Peterson	26,057	Michael J. Ure	33,089
Ronald L. Grudziecki	24,970	Teresa Stanek Rea	30,427	Charles F. Wieland III	33,096
Frederick G. Michaud, Jr.	26,003	Robert E. Krebs	25,885	Bruce T. Wieder	33,815
Alan E. Kopecki	25,813	William C. Rowland	30,888	Todd R. Walters	34,040
Regis E. Slutter	26,999	T. Gene Dillahunty	25,423	Ronni S. Jillions	31,979
Samuel C. Miller, III	27,360	Patrick C. Keane	32,858	Harold R. Brown III	36,341
Ralph L. Freeland, Jr.	16,110	Bruce J. Boggs, Jr.	32,344	Allen R. Baum	36,086
Robert G. Mukai	28,531	William H. Benz	25,952	Steven M. du Bois	35,023

and: _____

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P.O. Box 1404
Alexandria, Virginia 22313-1404

Address all telephone calls to: Bruce J. Boggs, Jr. at (703) 836-6620.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONTINUED) (Includes Reference to Provisional and PCT International Applications)		ATTORNEY'S DOCKET NO. 013550-087	
FULL NAME OF SOLE OR FIRST INVENTOR LAURENCE LAI Lawrence LAI		SIGNATURE Laurence Lai	
RESIDENCE Ontario Canada		DATE May 10 '99	
CITIZENSHIP Canada			
POST OFFICE ADDRESS 887 The Greenway, Mississauga, Ontario Canada L5G 1P7			
FULL NAME OF SECOND JOINT INVENTOR, IF ANY Neilson ZENG		SIGNATURE Zeng	
RESIDENCE Ontario Canada		DATE May 7, 1999	
CITIZENSHIP Canada			
POST OFFICE ADDRESS 88 Mutual Street, Toronto, Ontario Canada M5B 2N3			
FULL NAME OF THIRD JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			
FULL NAME OF FOURTH JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			
FULL NAME OF FIFTH JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			
FULL NAME OF SIXTH JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			
FULL NAME OF SEVENTH JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			
FULL NAME OF EIGHTH JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			
FULL NAME OF NINTH JOINT INVENTOR, IF ANY		SIGNATURE	
RESIDENCE		DATE	
CITIZENSHIP			
POST OFFICE ADDRESS			